

## REMARKS/ARGUMENTS

In the Office Action mailed October 24, 2008, claims 1-9, 15-20, and 30-32 were rejected. Additionally, claims 10-14 and 33 were objected to. In response, Applicants hereby request reconsideration of the application in view of the amendments and the below-provided remarks. No claims are added or canceled.

For reference, claim 1 is amended to clarify that the current sensor is integrated in the semiconductor device where the current to be measured is generated. Claim 2 is amended to clarify the meaning of the term “suitable for measuring current.”

### Objections to the Drawings

The current application is a U.S. National Stage application. The drawing requirements for U.S. National Stage applications are identified in MPEP 1825 and labeling of figures as “Prior Art” is not required (see PCT Rule 11.11). Further, MPEP 1893.03(f) states that “[t]he USPTO may not impose requirements beyond those imposed by the Patent Cooperation Treaty (e.g., PCT Rule 11).” In view of the above, Applicants respectfully assert that labeling Figure 2 as “Prior Art” is not required in the current application.

### Claim Objections

Claims 10-14 and 33 are objected to. The Office Action is silent on why claims 10-14 and 33 are objected to. Applicants assume that claims 10-14 and 33 recite allowable subject matter but are objected to because they depend from a rejected base claim. However, Applicants respectfully request clarification on the objections.

### Claim Rejections under 35 U.S.C. 112

Claim 2 was rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. In particular, claim 2 was rejected because it includes the term “suitable for measuring current.”

In regard to the rejection of claim 2, Applicants submit that claim 2 is amended to clarify the meaning of the language of the claim. Accordingly, Applicants respectfully request that the rejection of claim 2 under 35 U.S.C. 112, second paragraph, be withdrawn.

#### Claim Rejections under 35 U.S.C. 102

Claims 1-9, 15-20, and 30-32 were rejected under 35 U.S.C. 102(b) as being anticipated by Daughton et al. (U.S. Pat. No. 6,300,617, hereinafter Daughton). However, Applicants respectfully submit that these claims are patentable over Daughton for the reasons provided below.

#### Independent Claim 1

Claim 1 recites “wherinc the current sensing device is integrated in the semiconductor device where the current to be measured is generated and the current sensor is galvanically isolated from the conductive element” (emphasis added).

In contrast, Daughton does not disclose a current sensing device that is integrated into a semiconductor device where the current to be measured is generated. Daughton merely discloses a current sensing device with bonding pad interconnects that can be used to connect an external current source to the current sensing device. Daughton, col. 18, lines 55-60. In other words, the current sensing device disclosed in Daughton is designed to be a device that is external to the device generating the current to be sensed. The current sensing device disclosed in Daughton has an input transmission line that supplies a digital data input signal to the current sensing device from an external source. Daughton, col. 6, lines 16-21. Therefore, Daughton does not disclose a current sensing device that is integrated in the semiconductor device where the current to be measured is generated.

For the reasons presented above, Daughton does not disclose all of the limitations of the claim because Daughton does not disclose a current sensing device that is integrated in a semiconductor device where the current to be measured is generated. Accordingly, Applicants respectfully assert claim 1 is patentable over Daughton because Daughton does not disclose all of the limitations of the claim.

### Dependent Claims

Claims 2-20 and 30-33 depend from and incorporate all of the limitations of independent claim 1. Applicants respectfully assert claims 2-20 and 30-33 are allowable based on an allowable base claim. Additionally, each of claims 2-20 and 30-33 may be allowable for further reasons, as described below.

In regard to claim 2, Applicants respectfully submit that claim 2 is patentable over Daughton because Daughton does not disclose all the limitations of the claim. Claim 2 recites “A semiconductor device according to claim 1, wherein the current sensor is suitable for measuring current with a  $\mu$ A resolution” (emphasis added). In contrast, the cited portion of Daughton (current sensor interconnecting lead structure 24A) is completely silent on the current resolution. A description of 24A merely describes it as an interconnecting lead structure, although it appears to connect to a current sensor. Daughton, col. 14, lines 45-50. Daughton is silent on the current resolution of the current sensors 23A-23D. Daughton discloses that the current sensors measure relatively small currents, but Daughton does not disclose range or current resolution the current sensors can measure. Thus, Daughton does not disclose that the current sensor is suitable for measuring current with a  $\mu$ A resolution. Accordingly, Applicants respectfully assert that claim 2 is patentable over Daughton.

In regard to claim 3, Applicants respectfully submit that claim 3 is also patentable over Daughton because Daughton does not disclose all of the limitations of the claim. Claim 3 recites “wherein the current sensing device comprises at least one TMR device” (emphasis added). A TMR device is a tunnel magnetoresistance device such as a magnetic tunnel junction (MTJ), as explained in the current application. Page 3, lines 24-26. In contrast, the cited portion of Daughton (intermediate layer 18) for the TMR merely discloses that the intermediate layer 18 is a non-magnetic electrical conductor. Daughton, column 12, lines 39-44. Hence, the intermediate layer 18 is a non-magnetic electrical conductor and could not exhibit the tunnel magnetoresistance effect because it is non-magnetic. Daughton is silent on using a TMR device for current sensing. Accordingly, Applicants respectfully assert that claim 3 is patentable over Daughton because Daughton does not disclose “the current sensing device comprises at least one TMR device,” as recited in claim 3.

In regard to claim 4, Applicants respectfully submit that claim 4 is also patentable over Daughton because Daughton does not disclose all of the limitations of the claim.

Claim 4 recites “A semiconductor device according to claim 3, wherein the current sensing device shares an MTJ stack with an MRAM device” (emphasis added). The MTJ stack is utilized in the construction of MRAM devices, but also can be used for current sensing, as explained in the current application. Page 3, lines 29-34, and page 4, lines 1-7. In contrast, the cited portion of Daughton (combination of items 15-22) for the MTJ merely discloses that the combination of items 15-22 are a sandwich structure utilized in the current sensor. Daughton, column 11, lines 20-62. Similarly, the cited portion of Daughton (interconnecting network 14) for the MRAM device merely discloses that interconnecting network 14 allows for interconnecting the sensing circuit to other integrated circuit components. Daughton, column 11, lines 10-14. Daughton is completely silent on an MTJ and an MRAM device. Accordingly, Applicants respectfully assert that claim 4 is patentable over Daughton because Daughton does not disclose “the current sensing device shares an MTJ stack with an MRAM device,” as recited in claim 4.

In regard to claim 5, Applicants respectfully submit that claim 5 is also patentable over Daughton because Daughton does not disclose all of the limitations of the claim. Claim 5 recites “an electrically insulating material (103) designed to form a magneto-resistive tunnelling barrier” (emphasis added). The Office Action states that the intermediate layer 18 is purportedly an electrically insulating material. However, the intermediate layer 18 of Daughton is not an electrically insulating material. The intermediate layer 18 is an electrical conductor. Daughton, column 12, lines 39-44. Daughton is silent on utilizing an electrically insulating material to form a magneto-resistive tunneling barrier. Moreover, Daughton does not contain any reference to a magneto-resistive tunneling barrier. Accordingly, Applicants respectfully assert that claim 5 is patentable over Daughton because Daughton does not disclose “an electrically insulating material (103) designed to form a magneto-resistive tunnelling barrier,” as recited in claim 5.

In regard to claim 7, Applicants respectfully submit that claim 7 is also patentable over Daughton because Daughton does not disclose all of the limitations of the claim.

Claim 7 recites “the easy axis of the free layer is caused by shape elongation” (emphasis added). The cited portion of Daughton (column 12, line1, to column 13, line 29) describes how the easy axis is formed by squaring up the electrical resistance versus external applied field hysteresis loop which will leave the easy axis of the stratum film similarly directed. However, Daughton is silent on causing the easy axis by shape elongation. Accordingly, Applicants respectfully assert that claim 7 is patentable over Daughton because Daughton does not disclose “the easy axis of the free layer is caused by shape elongation,” as recited in claim 7.

In regard to claim 8, Applicants respectfully submit that claim 8 is also patentable over Daughton because Daughton does not disclose all of the limitations of the claim. Claim 8 recites “the current sensing device is subjected to an additional magnetic field that can either be direct, varying or alternating” (emphasis added). The cited portion of Daughton (the Abstract) does disclose magnetic fields, but they are created by the input current and are not an additional magnetic field. Daughton is silent on an additional magnetic field that can either be direct, varying, or alternating. Accordingly, Applicants respectfully assert that claim 8 is patentable over Daughton because Daughton does not disclose “the current sensing device is subjected to an additional magnetic field that can either be direct, varying or alternating,” as recited in claim 8.

In regard to claim 15, Applicants respectfully submit that claim 15 is also patentable over Daughton because Daughton does not disclose all of the limitations of the claim. Claim 15 recites “A semiconductor device according to claim 1, furthermore comprising a flux-concentrator to increase the magnetic field at the location of the current sensing device” (emphasis added). The cited portion of Daughton (combination of contact enhancer 26A and electric field interrupter 26B) purportedly forms a flux concentrator. Daughton discloses that the contact enhancer 26B serves to improve the electrical interconnection between the current sensor interconnecting lead structure 24F and further portions of the metallization interconnecting network 14. Daughton, column 16, lines 35-44. In other words, the contact enhancer 26B improves the electrical connection between the current sensors and the network 14. However, the contact enhancer 26B does not increase the magnetic field at the location of the current sensing device, as recited in the claim. Daughton is completely silent on a flux-concentrator to

increase the magnetic field at the current sensing device. Accordingly, Applicants respectfully assert that claim 15 is patentable over Daughton because Daughton does not disclose “A semiconductor device according to claim 1, furthermore comprising a flux-concentrator to increase the magnetic field at the location of the current sensing device,” as recited in claim 15.

In regard to claim 16, Applicants respectfully submit that claim 16 is also patentable over Daughton because Daughton does not disclose all of the limitations of the claim. Claim 16 recites “A semiconductor device according to claim 15, wherein the flux-concentrator comprises a dummy MTJ stack which is patterned around at least one vertical conduction component” (emphasis added). Here although the language of claim 16 should be interpreted independently of claim 15, Applicants respectfully assert the remarks provided above in regard to the rejection of claim 15 also apply to the rejection of claim 16. Accordingly, Applicants respectfully assert claim 16 is patentable over Daughton because Daughton does not disclose a flux-concentrator, as recited in claim 16.

## CONCLUSION

Applicants respectfully request reconsideration of the claims in view of the amendments and remarks made herein. A notice of allowance is earnestly solicited.

Respectfully submitted,  
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